

VIBRATORY CONVEYOR HAVING SPRING-MOUNTING CROSS-MEMBER ASSEMBLIES

TECHNICAL FIELD

The present invention relates generally to vibratory conveyor structures, and more particularly to an improved vibratory conveyor construction including a support structure having cross-member assemblies configured to facilitate operative connection of the conveyor springs to the support structure, while enhancing the structural integrity of the structure.

BACKGROUND OF THE INVENTION

Vibratory conveyor devices are in widespread use in view of their versatile material-handling capabilities. Such devices typically include a generally elongated trough or bed which is vibrated by an associated drive system so that material is conveyed along the length of the trough.

In typical constructions of so-called two mass vibratory conveyors, a support structure or base of the conveyor includes a pair of longitudinal base members typically constructed from heavy wall tubing or solid plate steel to obtain the desired structural characteristics, and in part to obtain the specifically desired weight relationship between the trough and the support structure. Generally speaking, the total stroke of the conveyor is divided between the trough and the support structure, including the base members, in inverse proportion to their mass ratio. Since it is desirable to minimize the vibratory motion of the support structure (to thereby facilitate isolation of the conveyor's transmitted vibration to surrounding structures), the support structure, including the base members, is typically more than twice the weight of the trough structure, and in some cases, as much as eight times or more in weight. In some designs, it is often necessary to add ballast weight to the support structure in order to obtain the desired base stroke. Some vibratory conveyor designs, like the base-excited conveyor, are inherently advantageous from an overall weight perspective, because the stroke of the base is dependent upon the tuning of the conveyor's spring/mass system with respect to the desired operating frequency.

In order to maintain the required stiffness of the support structure, and to prevent unwanted torsional and vertical bending modes of the structure that may be excited at the operating frequency of the conveyor, cross-members, typically made from steel tubes, angle, or channel sections, are connected between the longitudinal base members to form a stiff ladder-like frame construction. It is common practice to connect the spring-mounting elements of the conveyor at the points where these cross-members attach to the longitudinal base members to thereby take advantage of the structural support provided by the cross-members.

Experience has shown that one problem encountered with current conveyor designs is the cost associated with the weight, construction, and complexity of the support structure. This problem is aggravated if an all stainless steel construction is mandated by specific sanitation requirements for the conveyor application. While the base-excited conveyor design is more advantageous with respect to such considerations, it will be appreciated that it is desirable to further reduce the overall weight of the machine, while maintaining the same operating capacity, thus providing desired operating efficiencies.

To this end, efforts have been made to develop a base-excited conveyor construction employing the lightest possible support structure construction. However, because of

the lightweight formed sheet metal sections used in this construction, it is necessary to avoid fatigue failure at the spring connections to the base members which could result from concentrated shear and bending loads to which the base members are subjected at the spring connections. While previous constructions have employed so-called "scab" reinforcing plates, castings, blocks, or the like for longitudinally spreading the loads to which the mounting blocks for the springs are subjected, such constructions necessarily result in a heavier construction. This, of course, is self-defeating in the context of providing a relatively lightweight base-excited conveyor construction.

The present invention contemplates an improved vibratory conveyor construction, including an improved support structure which can be configured from relatively lightweight components, thus facilitating economical manufacture and operating efficiency.

SUMMARY OF THE INVENTION

The vibratory conveyor construction embodying the principles of the present invention includes an improved support structure having cross-member assemblies which facilitate connection of springs of the conveyor to relatively light, thin, longitudinal base members of the support structure. The arrangement is configured to substantially abate fatigue failure, with the preferred connection of the cross-member assemblies to the base members with mechanical fasteners desirably minimizing heat warpage that can occur attendant to welding of sheet metal structures. By positioning the spring-mounts at those portions which are rigidified by the cross-member assemblies, the structural integrity of the support structure, and the spring connections, is desirably enhanced.

In accordance with the illustrated embodiment, the present vibratory conveyor includes a generally elongated conveyor trough along which material is conveyed. The conveyor further includes an elongated support structure extending generally beneath the conveyor bed, and a plurality of springs operatively connecting the conveyor bed to the support structure. In a base-excited conveyor design, a vibratory drive is operatively connected to the support structure, the vibration of which, in turn, effects vibratory motion of the conveyor trough via the plurality of springs interconnecting the trough and the support structure.

In accordance with the present invention, the support structure comprises a pair of laterally spaced, longitudinally extending base members, and a plurality of transversely extending spring-mount cross-member assemblies for connecting the springs of the conveyor to the base members. In the preferred relatively lightweight configuration of the present conveyor, each of the longitudinally extending base members has a generally inwardly open, channel-like configuration, including a vertical web portion, and upper and lower flange portions respectively extending from the web portion.

Each of the cross-member assemblies is of a straightforward fabricated configuration, preferably of a standardized design to take advantage of manufacturing scale, and to minimize cost and improve manufacturing turnaround time. In particular, each cross-member assembly comprises a pair of end plates respectively connected to an inside surface of the web portions of the base members, and a pair of spring-mounts respectively mounted on the end plates for respective mounting of a pair of the springs of the conveyor thereto. In the preferred form, each spring-mount extends through an opening in the web portion of the respective one